 SCH3U

Test: Unit 1(Marking scheme)

Matter, Chemical Trends and Chemical Bonding

Section A – Multiple Choice

1) Which of the following ions always contain more than one item?

1. cations
2. multi-valent ions
3. poly-atomic ions
4. anions

2) What is the energy change that occurs when an electron is gained by an atom in the gaseous state?

1. ionization energy
2. electron affinity
3. ionization
4. electro-negativity

3) Which of the following is a molecular compound?

1. NH3
2. CaCl2
3. NO3-
4. Na2O

4) What type of bond is likely to form between the elements molybdenum, Mo and chlorine, Cl?

1. Non polar covalent
2. Polar covalent
3. Ionic
4. None of the above

5) Which of the following is true of DEET?

1. It is synthetically prepared
2. It is white and powdery solid
3. It is colourless liquid with faint odour
4. All of the above

6) Of the following attractions which is generally the weakest attractive force between particles?

1. Ionic bond
2. Covalent bond
3. Dipole - dipole force
4. London dispersion force

7) Which of the following substances is most likely to have hydrogen bonding?

1. Ammonia, NH3 (g)
2. Methane, CH4 (g)
3. Phosphine, PH3 (g)
4. All of the above

8) Which property of the element decreases as you proceed from left to right across a row on the periodic table?

1. Atomic radius
2. Ionic radius
3. Ionization energy
4. Electron affinity

9) Which one of the following trends is incorrect?

a) Atomic mass always increases in a period.

b) Ionization energy always increases in a group/family.

c) Atomic radius always increases in a group/family.

d) Number of protons always increases in a period.

10) Which one of the following is generally NOT a property of ionic compounds?

a) High melting points

b) High boiling points

c) Brittle in the solid state

d) Conducts electricity in the solid state

Section A – True/False

1. Bohr’s model of the atom includes neutrons located in energy levels. False

Correct statement: Bohr’s model of the atom includes electrons located in energy levels.

1. The noble gases exist as individual atom and are quite reactive. False

Correct statement: The noble gases exist as individual atom and are quite unreactive.

1. Moving down a group, ionization energies tend to decrease. True
2. The majority of known compounds are molecular. True
3. The correct name for the compound (NH3)2SO4 is ammonium sulphate. False

Correct statement: The correct name for the compound (NH4)2SO4 is ammonium sulphate

1. Atomic radius is measurement of the size of an atom. True
2. There are no attractions (bonds) between two metal atoms. False

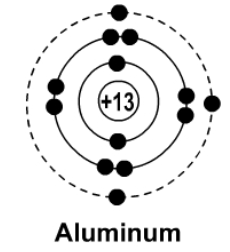
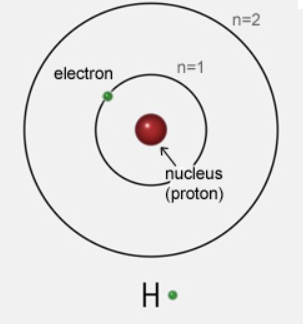
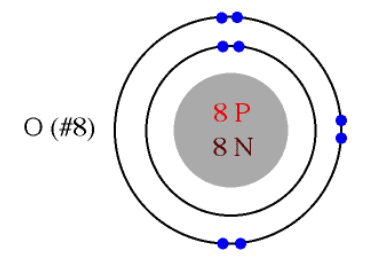
Correct statement: There are metallic bonds between two metal atoms.

Section B – Matching

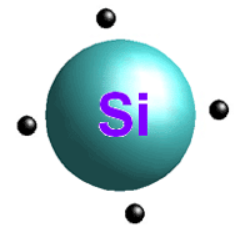
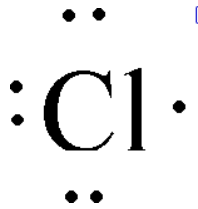
1. – D
2. – H
3. – E
4. – A
5. – G
6. – C
7. – B
8. – J

Section C – Short Answer

1. By losing, by gaining and by sharing electrons.
2. Bohr-Rutherford’s diagrams:

1. Lewis diagrams:

1. Atomic number of Al – 13

Mass number of Al – 27

1. When an atom gains an electron – energy is released

When an atom loses an electron – energy is required

1. Any ionic compound in water acts as an electrolyte because it dissociates in water to furnish ions which help in the conduction of electricity.
2. Zero sum rule – For neutral chemical formulas containing ions, the sum of the positive and negative ions must equal to zero.
3. SO42- - Sulphate ions

NO31- - Nitrate ions

BrO31- - Bromate ions

1. Three types of intermolecular forces are – dipole-dipole, hydrogen bonding and dispersion forces.

Dispersion forces are referred to as Vander Waals forces.

1. Substance IV is most likely to be an ionic compound as – it is solid in pure state, is highly soluble in water and has high solution conductivity.
2. HF and NH3
3. There are thousands of compounds that are uncommon or have multiple names. Also, the common name is usually not recognized internationally. What looks like *water* to you might look like *agua* or *vatten* to someone else. To allow chemists to communicate without confusion, there are naming conventions to determine the systematic name of a chemical.

Section D – Long Answer

1. a. Across a period the usual trend is the increase in ionisation energy.

b. Factors affecting the size of ionisation energy:

The charge on the nucleus – On moving from left to right, the effective nuclear charge increases.

The distance of the electron from the nucleus – On moving from left to right in a period, the distance of the electron from the nucleus decreases a little .

The number of electrons between the outer electrons and the nucleus - The lessening of the pull of the nucleus by inner electrons is known as screening or shielding.

c. From top to bottom the ionization energy is decreasing.

d. The charge on the nucleus – On moving from top to bottom, the effective nuclear charge does not increase.

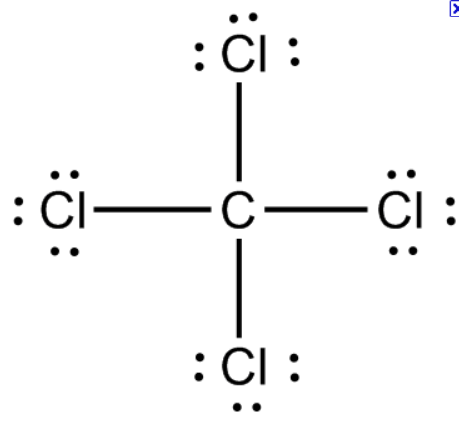
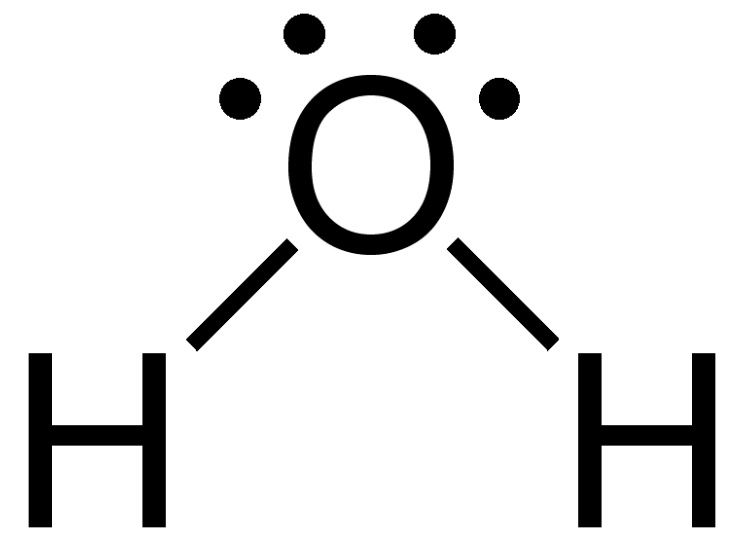
The distance of the electron from the nucleus – On moving from top to bottom in a group, the distance of the electron from the nucleus increases .

The number of electrons between the outer electrons and the nucleus - The lessening of the pull of the nucleus by inner electrons is known as screening or shielding.

1. Average atomic mass of element X =

0.1264 x 302.04 + 0.1823 x 304.12 + 0.6913 x 305.03

= 38.178 + 54.441 + 210.867 = 303.486 u or g/mol



The electronegativity difference between C and Cl is 0.5. In CCl4, each carbon-chlorine bond is polar, but the molecule is non-polar. Here, how they cancel out isn't as obvious, but they do. CCl4 is a tetrahedral molecule, and the 4 C-Cl polar bonds cancel each other out.  
In water, Electronegativity O - Electronegativity H  
3.44-2.20=1.24  
The electronegativity between H and O is 1.24.  
Therefore, H2O is polar covalent.

1. In beaker (B) - Dipole-dipole forces act between molecules possessing permanent dipoles. Ends of dipoles possess partial positive and negative charges which account for electrostatic forces of attraction and hence dipole-dipole forces. We can guess that if a molecule is polar then mostly it is bonded by this force.  
   In beaker (A) - London forces--- Assume two molecules having no net dipole moment. Both have symmetrical charge distributions. But if by chance the electronic cloud of one molecule becomes asymmetrical and hence induces an instantaneous dipole in another molecule. Now this molecule induces a dipole in nearby molecules. As a consequence the both atoms are electrostatically attracted. Two non-polar molecules are generally bonded by this force.

Substance (A) will boil at a lower temperature as the forces of attraction between the molecules are weak and hence less energy is required to break the bond between the molecules.